

## A NEW SUBSPECIES OF THE GENUS DIPHASCON AND TWO NEW RECORDS OF TARDIGRADA (EUTARDIGRADA, HYPHIBIIDAE, MACROBIOTIDAE) FROM CHINA

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**Abstract** A new subspecies of *Diphascon scoticum* Murray, 1905 and two new records of tardigrades were described and reported. The new subspecies, *D. s. qinlingensis* subsp. nov., differs from the nominate subspecies mainly by the constricted common basal tract. The new subspecies and the two new record species *Richtersius coronifer* (Richters, 1903) (Eutardigrada, Macrobiotidae) and *Diphascon scoticum* (Eutardigrada, Hypsibiidae) were collected from Qinling mountains, China.

**Key words** Tardigrada, new subspecies, new record, China.

The earliest known papers on the Tardigrada fauna of China were published in 1937 (Rahm, 1936-1937a, 1936-1937b, 1937; Mathew, 1937a, 1937b). A total of 25 species from nine municipalities or provinces were reported in these papers. Since then, no additional papers on tardigrades from China were published until 1963. The tardigrada fauna of Guangdong Province was respectively reported in 1963 and 1974 (Bartoš, 1963; Pilato, 1974a). About 35 species of tardigrades have been reported from China in these papers. From 1996 to present, 7 papers on Tardigrada from China have been published, of which 3 papers were published in Chinese with English summary and one paper in English by Chinese researchers (Beasley, 1999, 1996; Kaczmarek and Beasley, 2002; Yang, 1999, 2002a, 2002b, 2003). A total of over 60 species belonging to 17 genera of tardigrada from China have been reported to date. In summer of 2003, the authors of this article took a trip to Mt. Qinling Mountains which traverses from west to east in central China. A total of 186 samples of mosses and lichens growing on rocks and soil or tree trunk were collected from the middle range of Mt. Qinling. A new subspecies and two new record species of Tardigrada were found in those mosses and lichens.

The genus *Diphascon* was later split into 4 genera: *Hebesuncus*, *Diphascon*, *Mesocrista* and *Platycrista*, and the genus *Diphascon* was further split into two subgenera: *Diphascon* and *Adropion* (Pilato, 1987).

### Materials and methods

Tardigrades were extracted from moss and lichen

collected from Qinling Mountains, which stretches from west to east in the central part of China. Tardigrade specimens were mounted in Hoyer's medium on microscope slides after fixation with 85% boiling alcohol and the coverslips were sealed with epoxy paint for identification. Observation and measurements were made using phase contrast microscopy (PCM), an eyepiece micrometer. Photos were taken with digital camera (Sony DSG F717) mounted on the microscope.

### Taxonomic accounts

Eutardigrada Marcus, 1927

Parachela Schuster, Nelson, Grigarick, & Christenberry, 1980

Hypsibiidae Pilato, 1969

*Diphascon* Plate, 1889

*Diphascon (Adropion) scoticum* Murray, 1905

*Diphascon (Adropion) scoticum qinlingensis* **subsp. nov.** (Figs 1-8)

Holotype. Adult, sex unknown (slide number Sh03/11/001), Mt. Qinling, Aug. 2003. Paratype. Only an exuvia with eight eggs in it was found.

Type locality. Middle range of Mt. Qinling (34°9' N, 108°57' E), Shaanxi Province, China.

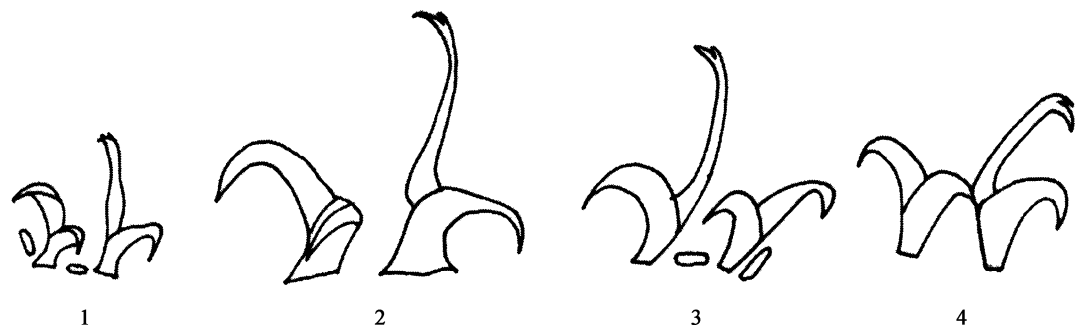
Etymology. The new subspecies was named after the type locality Mt. Qinling, China.

Description. Body very slender, not narrowing anteriorly, eyes absent, colorless, cuticle smooth. Bucco-pharyngeal tube very narrow and long; without drop shaped structure on it; posterior portion of bucco-pharyngeal tube flexible with spiral thickening on its wall; pharyngeal tube about as long as pharynx. The latter very elongated (about two times longer than

wide). Small apophyses present, and three macroplacoids in the shape of slender elongated rods present. The third macroplacoid the longest, and the first macroplacoid slightly longer than the second one. Mi-

croplacoid present, very small. Septulum absent. Measurements of body length and some other structures are listed in Table 1.

Cuticular bars exist on the first three pair of legs,



Figs. 1-4. The double claws. 1-2. *Diphascon* (*Adropion*) *s. scoticum*. 1. On the 2<sup>nd</sup> pair of legs. 2. On the 4<sup>th</sup> pair of legs. 3-4. *Diphascon* (*Adropion*) *s. qinlingensis* subsp. nov. 3. On the 2<sup>nd</sup> pair of legs. 4. On the 4<sup>th</sup> pair of legs.

**Table 1. Dimensions (in  $\mu\text{m}$ ) of some structures of *D. (Adropion) s. qinlingensis* subsp. nov.\***

		Individual No. 1	Individual No. 2
Body length		214.0	221.9
Buccal tube length		20.9	
Buccal tube width		4.7	
pt*		22.5	
Stylet supports pt		75.0	
Placoid row+ microplacoid		27.4	
pt		131.3	
First macroplacoid		7.3	
pt		35.0	
Second macroplacoid		6.5	
pt		31.3	
Third macroplacoid		9.1	
pt		43.8	
Microplacoid		2.6	
pt		12.5	
First pair of legs			
Internal claw length	Primary branch	13.1	10.4
	Second branch	7.8	7.8
External claw length	Primary branch	18.3	15.7
	Second branch	9.1	10.4
Second pair of legs			
Internal claw length	Primary branch	15.7	10.4
	Second branch	9.1	7.8
External claw length	Primary branch	20.9	15.7
	Second branch	10.4	10.4
Third pair of legs			
Internal claw length	Primary branch	15.7	10.4
	Second branch	10.4	7.8
External claw length	Primary branch	18.3	15.7
	Second branch	10.4	10.4
Fourth pair of legs			
Anterior claw length	Primary branch	13.1	10.4
	Second branch	10.4	7.8
Posterior claw length	Primary branch	20.9	15.7
	Second branch	13.1	10.4

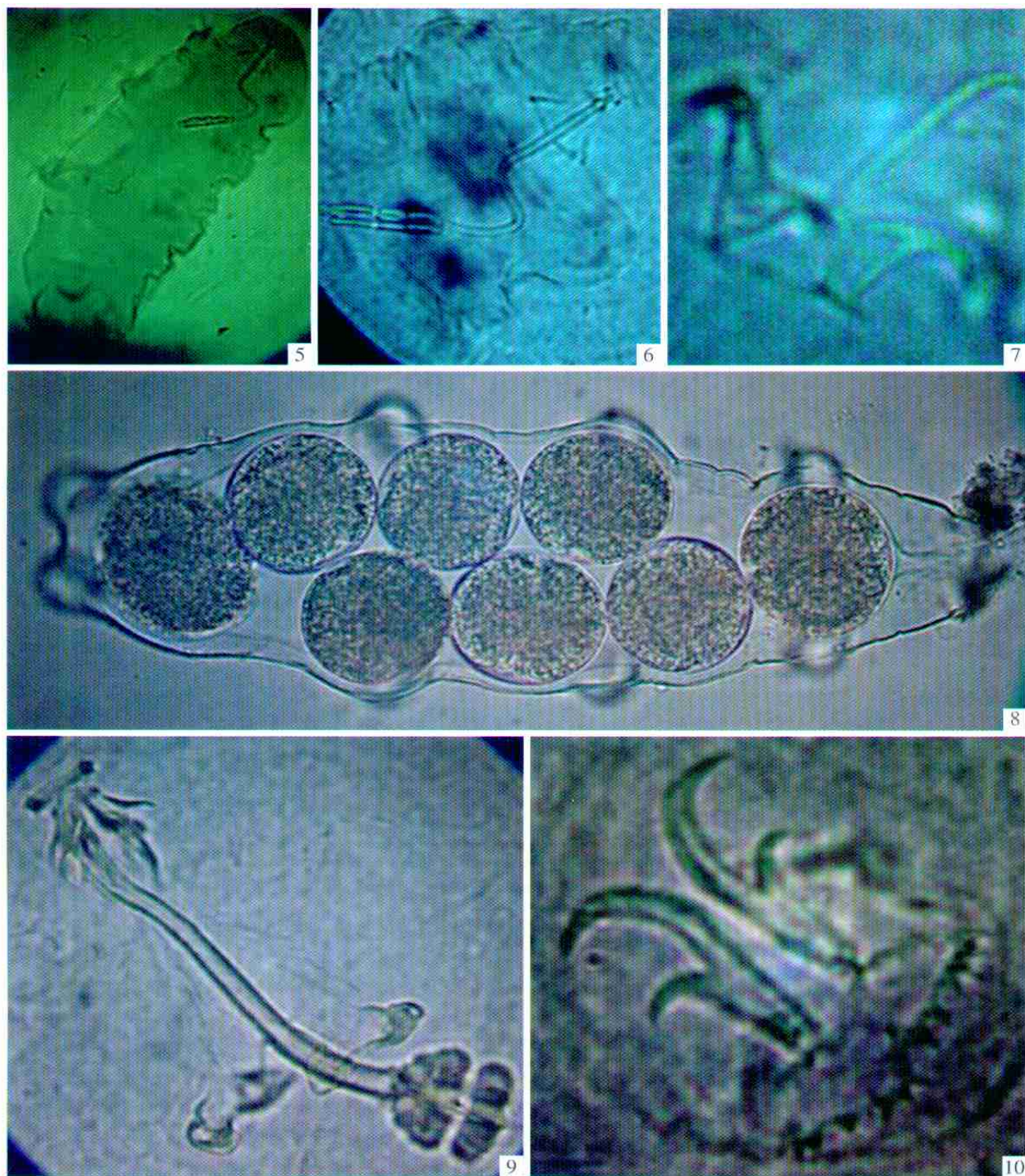
\* pt is the percent ratio between the length of a structure and the length of buccal tube measured from the medio-dorsal transversal ridge to the base of the pharyngeal apophyses (Pilato, 1981).

one between the internal diploclaw and the external diploclaw, arranged transversely, another arranged obliquely on the internal side of the internal diploclaw. The two diploclaws on each leg very different from each other in size, but not in shape, the principal branch long and slender, with small accessory points near the tip of the principal branch. The common basal part remarkably constricted (Figs. 3-4).

Eggs laid in the exuvia (Fig. 6). Eight eggs in a batch. The diameter of the eggs is 41  $\mu\text{m}$  to 46  $\mu\text{m}$ . Eggs round or oval. The surface of the egg smooth. In Mt. Qinling areas, this species laid eggs in late spring. The exuvia full of water, and the wall of it highly keratinized.

Remarks. The main characters, such as the habitus, measurements, buccal apparatus and claws, especially the buccal apparatus and the main characters of the claws, of the specimens are consistent with *D. (Adropion) scoticum*, but differs markedly from other species (15 species) of subgenus *Adropion* by buccopharyngeal tube, or by placoids, or by the cuticular bars near the base of the claws. Undoubtedly, these two specimens belong to *D. (Adropion) scoticum*. *D. (Adropion) scoticum* is a species with wide distribution. It was not reported from China before. The specimens collected from Mt. Qinling are new to the Chinese records. Our specimens remarkably differs from the specimens collected from other localities in the world (Ito, 1995; Ramazzotti and Maucci, 1983) by the common basal part of the double claws not expanded, but extremely constricted. Therefore our specimens represent a new subspecies of *D. (Adropion)*





Figs 5-8. *Diphason (Adropion) scoticum qinlingensis*. 5. Habitus. 6. Buccal apparatus. 7. Diploc claws on the 4th pair of legs. 8. Eggs in exuvia. Figs 9-10. *R. coronifer*. 9. The buccal apparatus. 10. The double claws on the third pair of legs.

*scoticum*. This new subspecies has no septulum as described by some authors (Ito, 1995; Pilato, 1974b). To date, there were 2 subspecies in this species, they are *D. s. scoticum* and *D. s. qinlingensis* subsp.

*Richtersius* Pilato & Binda, 1989

*Richtersius coronifer* (Richters, 1903) (Figs 9-

10)

nov., and the new subspecies differs from the nominate subspecies by the constricted common basal part of the double claws.

Macrobiotidae Thulin, 1928

Description. Yellow in colour; cuticle smooth. Buccal tube narrow; the appendices for the stylet muscle insertion of hook shape present on the buccal tube.

Pharynx slightly oval with 2 short and wide macroplacoids, the first macroplacoid and the second one about equal in size ( Table 2) . Microplacoid and septulum absent.

**Table 2. Dimensions (in μm) of some structures of *R. coronifer* (Specimens from Mt. Qínlíng)\* .**

		Number of structures measured	MnMx	Mean±SD
Body length		12	388. 0 834. 2	674. 3±66. 7
Buccal tube length		12	54. 8 94. 0	84. 8±11. 2
Buccal tube width		12	2. 7 5. 2	4. 57±0. 8
pt*		12	4. 7 5. 9	5. 4±0. 6
Stylet supports pt		12	66. 2 72. 1	69. 7±1. 8
Placoid row		12	10. 4 20. 9	17. 1±2. 6
pt		12	19. 1 22. 9	20. 2±1. 0
First macroplacoid		12	5. 2 8. 4	7. 6±0. 9
pt		12	8. 3 10. 0	9. 0±0. 5
Second macroplacoid		12	5. 2 9. 4	7. 6±1. 2
pt		12	7. 1 10. 6	9. 0±0. 9
First pair of legs				
Internal claw length	Primary branch	12	15. 7 31. 3	25. 7±4. 7
	Second branch	12	7. 8 19. 6	16. 4±3. 3
External claw length	Primary branch	12	15. 7 31. 3	25. 7±4. 7
	Second branch	12	7. 8 19. 6	16. 4±3. 3
Second pair of legs				
Internal claw length	Primary branch	12	15. 7 31. 3	25. 7±4. 7
	Second branch	12	7. 8 19. 6	16. 4±3. 3
External claw length	Primary branch	12	15. 7 31. 3	25. 7±4. 7
	Second branch	12	7. 8 19. 6	16. 4±3. 3
Third pair of legs				
Internal claw length	Primary branch	12	15. 7 31. 3	25. 7±4. 7
	Second branch	12	7. 8 19. 6	16. 4±3. 3
External claw length	Primary branch	12	15. 7 31. 3	25. 7±4. 7
	Second branch	12	7. 8 19. 6	16. 4±3. 3
Fourth pair of legs				
Anterior claw length	Primary branch	12	18. 3 36. 5	29. 2±5. 2
	Second branch	12	10. 4 23. 5	18. 9±3. 7
Posterior claw length	Primary branch	12	18. 3 36. 5	29. 2±5. 2
	Second branch	12	10. 4 23. 5	18. 9±3. 7

Mn= minimum, Mx= maximum, SD= standard deviation. \* pt is the percent ratio between the length of a structure and the length of buccal tube measured from the medio dorsal transversal ridge to the base of the pharyngeal apophyses (Pilato, 1981) .

The median crest of muscle insertion on the buccal tube with a strongly corrugated margin, which both dorsally and ventrally forms an obvious rounded hook, the ventral one markedly larger.

Diplodawl of the *hufelandi* type. 2 strong accessory points present on the primary branch, and the primary branch longer than the secondary; this species characterized by the enormous dentate lunule, which exists at the base of each doubleclaw and which bears about 12 teeth; the lunule of the fourth pair of legs more developed ( Figs. 9-10) .

Remarks. *Richtersius coronifer* was first reported from Norway and Spitsbergen Island in 1903. It is a fairly common species, and was found in many European localities, in South America, in the Arctic, and in Turkey (Ramazzotti and Mauzzi, 1983) . This species was first placed in the genus *Macrobiotus*, then in *Adorybiotus* (Maucci and Ramazzotti, 1981) . A new genus, *Richtersia* was erected for it in 1987 (Pilato and Binda, 1987) , and this generic name was replaced

with *Richtersius* ( Pilato and Binda, 1989) . *Richtersius* contains only one species. This genus differs from *Macrobiotus* and *Adorybiotus* mainly by large dentate lunulae and well developed stylet furcae with posterior lateral process divergent. This species has never been reported from China before. The thickness of the buccal tube wall near the site where the stylet supports attach in the specimens collected from Mt. Qínlíng in most specimens is over 2. 5 μm. No such character was mentioned in the descriptions of the specimens collected from other localities in the world. If it is true, then specimens from Mt. Qínlíng probably represent a new subspecies of *Richtersius coronifer* .

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## 中国缓步动物门一新亚种及两新纪录种记述

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**摘要** 报道了我国缓步动物门1新亚种 *Diphascon (Adropion) scoticum qinlingensis* subsp. nov. 和中国2新纪录 *Richtersius coronifer* (Richters, 1903) (Eutardigrada, Macrobiotidae)

**关键词** 缓步动物门, 新亚种, 新纪录, 中国.

**中图分类号** Q959.16

和 *Diphascon scoticum* Murray, 1905 (Eutardigrada, Hypsibiidae). 新亚种主要以爪的主枝基部极度收缩区别于世界其他产地的标本 (指名亚种)。新亚种和新纪录均采自秦岭山区。